BIOLOGICAL STUDIES OF THE ONAKAWANA AREA

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TASK FORCE ONAKAWANA
WORKING PAPER #3

BIOLOGICAL STUDIES

OF

THE ONAKAWANA AREA

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WILDLIFE RESEARCH

MINISTRY OF NATURAL RESOURCES

November 1, 1972

LIST OF MAPS AND FIGURES

INTRODUCTION

In May, 1972, a Task Force was established to study the environment impact of possible development of the lignite coal deposits at Onakawana. The following report has been prepared for the Task Force with the objective of satisfying the instruction "to investigate, in general terms, the environmental effects which would be brought about by the development of the Onakawana (James Bay) lignite deposits". The section on vegetation was prepared by Mr. J. Riley, assisted by Mr. B. Mackey, that on fish by Mr. R. Burdett, those on birds and mammals by Miss N. Arthur and Mr. I. Watt. All are employees of the Ministry of Natural Resources with the exception of Mr. R. Burdett who is with the Ministry of the Environment. The discussion was prepared by Mr. Standfield of the Ministry of Natural Resources.

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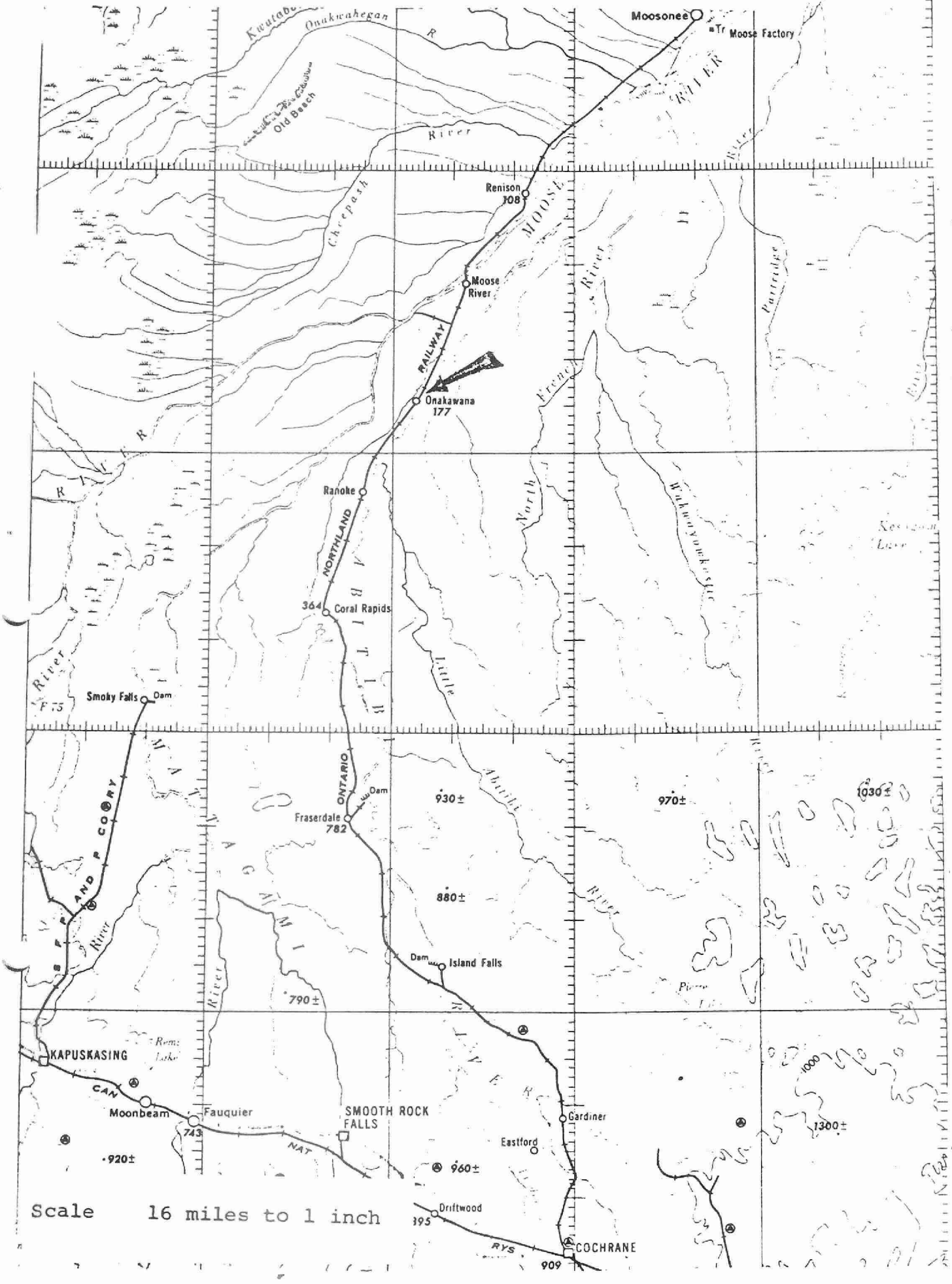
STUDY AREA

Onakawana is located at Mile 126 on the Ontario Northland Railway which runs from Cochrane north to Moosonee (Map 1). The biological study area is bounded on the west by the Mattagami River, on the east by the Abitibi River, on the south by the southern boundary of Morrow township and on the north by an east-west line running through Moose River Crossing (Map 2.). The area lies within the Hudson Bay Lowlands which has been divided into four physiographic subdivisions, with the Moose River area occurring in what is called the "Dry Zone" (Coombs, 1954).[1] Although this zone is not adequately drained, it is the driest of the four zones. Using aerial photographs, Coombs [2] found that "approximately 30 per cent is covered by muskeg and swamps, 30 per cent by lakes and rivers and the remaining 40 per cent by comparatively dry land". The Onakawana area has a lower proportion of open water. Good stands of timber occur adjacent to the rivers and streams where drainage is adequate to allow their growth. Between the approximately parallel northward draining rivers and streams lie the areas of muskeg and swamp.

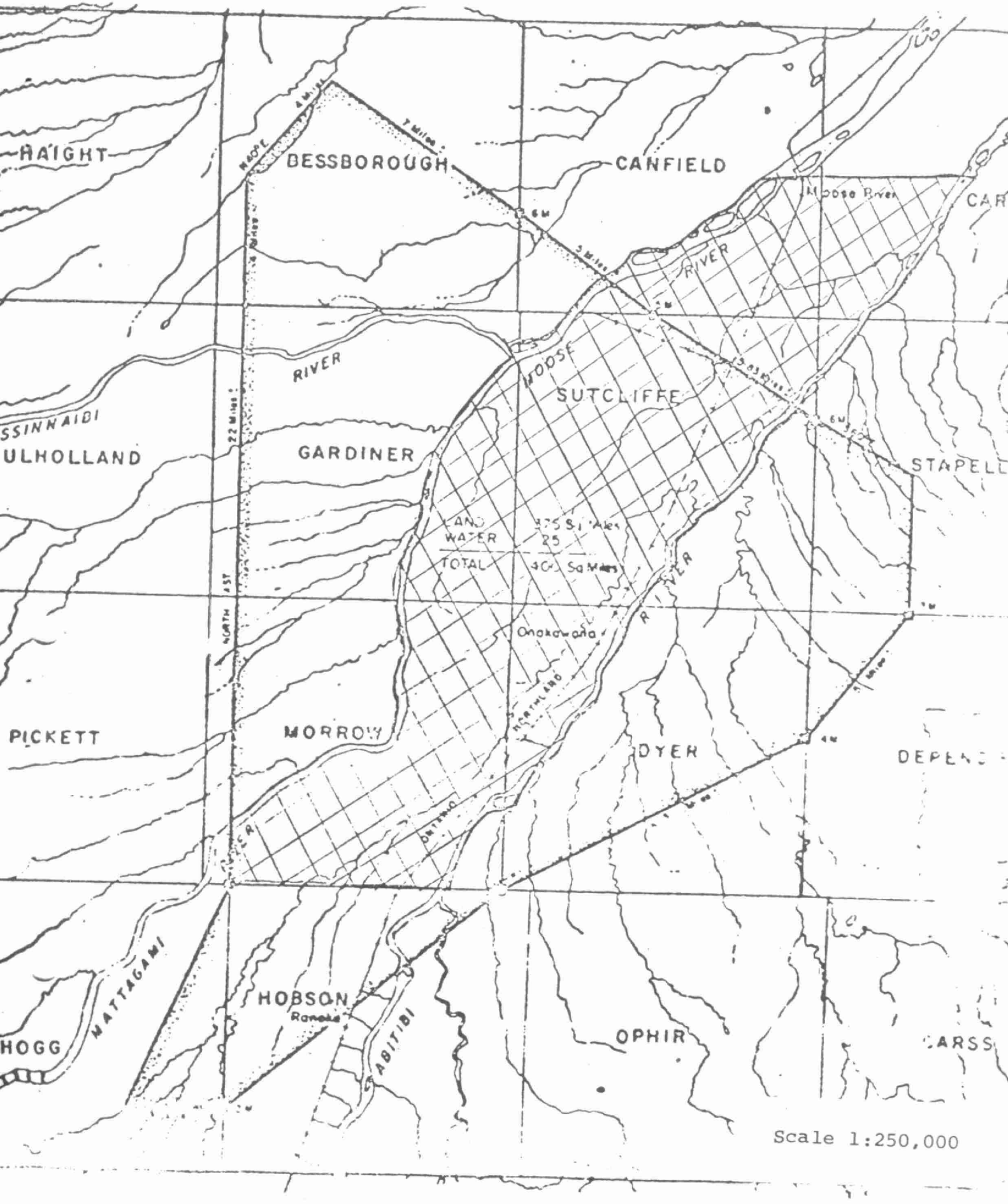
Johnston and Sharpe (1923)[3] give a good description of the type of forest growth characteristic to this area. They state:

(1) Coombs, D.D. (1954) The Physiographic Subdivisions of the Hudson Bay Lowlands South of 60 Degrees North.
(2) op. cit.
(3) Johnston and Sharpe (1923), Report of James Bay Forest Survey, Moose River Lower Basin.

Map 1. Location of Onakawana lignite deposits.



Map 2. Area of ecological study.



study area

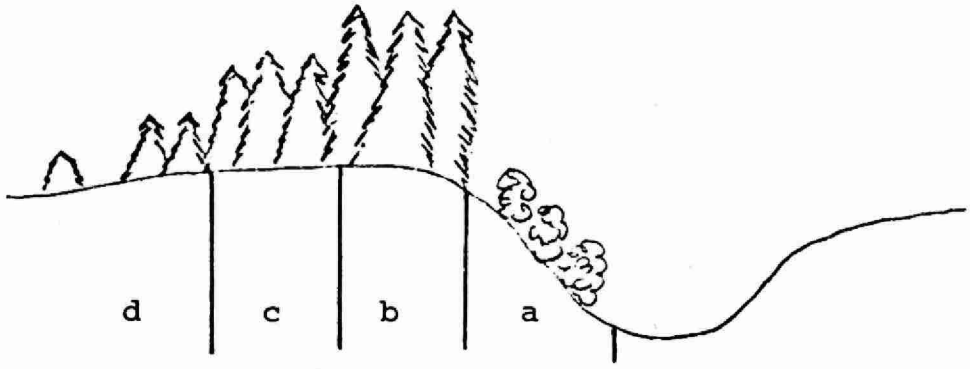
exploratory licence boundary

> "... the rivers everywhere are lined with a narrow belt of mixed evergreen and broad leaved trees. Beyond this belt and parallelling it, runs one of practically pure black spruce. As one gets further from the river, the spruce rapidly and progressively falls off in diameter and height, the number of trees per acre increasing, with a tendency towards growth in clumps. Finally, at a distance in general of a few hundred yards up to one-half mile in the coastal plain, trees of commercial size are left behind, and a scrub type is entered. Here the trees are extremely dwarfed although very old, and eventually give way to open muskeg."

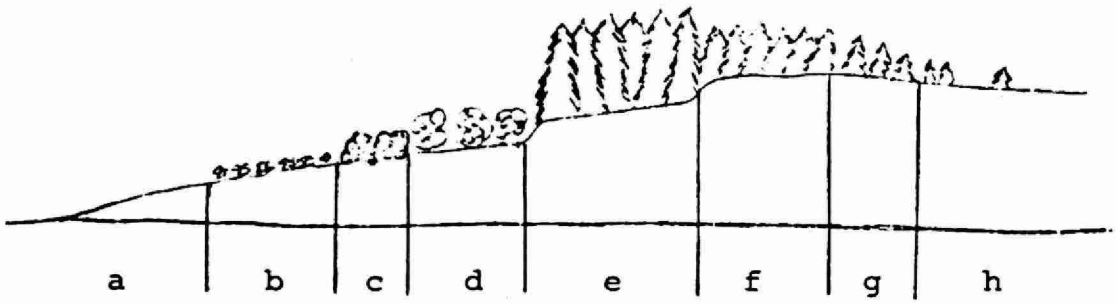
Hustich (1957)[4] gives a similar description of the forest growth adjacent to rivers (Figure 1). More detailed descriptions of the forest cover are presented in Section I on Vegetation.

(4) Hustich, I (1957), On the Phytogeography of the Hudson Bay Lowlands.

Figure I Forest growth along rivers from Hustich (1957)



Profile of a small river inland. a = slope with some alders; b = well grown white spruce forest (narrow belt with some poplars or birch); c = black spruce muskeg; d = open bog or open bog forest.



Profile of a larger river (mouth). a = fragmentary vegetation, if any (= "new land"); b = low willow field; c = denser and higher willows with some alders; d = balsam poplar grove; e = white spruce feather moss forest; f = black spruce lichen woodland; g = black spruce muskeg; h = open bog or open bog forest.

STUDIES CONDUCTED

Two field trips were made to the Onakawana site; the first covered a period from August 4 to September 2, and the second a period from September 25 to October 10. An inventory of vegetation, fish, birds and mammals was made based on observations during these two field trips.

Due to the size of the study area and the difficulty of movement across the muskeg, the majority of the work was conducted on the area between the Abitibi and Onakawana Rivers in the vicinity of Mile 126 on the O.N.R. Some work was done between the Onakawana River and Medicine Creek; very little time was spent on the area between Medicine Creek and the Mattagami River.

Approximately three and a half hours were spent flying over the area in a Bell G-4 and a Hughes 500 helicopter. These flights were helpful in gaining an overview of the area and for comparing actual vegetation patterns with aerial photographs of the area. Three days in August were spent canoeing the Moose and Mattagami Rivers from Moose River Crossing, 26 miles upstream. In October an aerial survey of beaver populations was conducted over all rivers and streams in the study area.

Section I of the following report contains a description of plant cover, a vegetation map and a list of dominant species in each vegetational zone. An extensive plant collection was made during August and

identification of all species found will not be completed before the spring of 1973. Section II contains the results of reptile and amphibian observations. Section III contains the results of fisheries observations. Section IV and V contain the results of the bird and mammal observations made during the two field trips.

Section I - Vegetation

The vegetation of the Onakawana area is influenced indirectly by the Devonian bedrock and by subsequent marine deposits of the Pleistocene period. Two large rivers, the Abitibi and the Mattagami, flank the 200 square mile study area. They, along with the three creeks and the larger Onakawana River which flow through the area, have a marked effect on the vegetation. Leaching of the limestone bedrock and the calcareous marine depositions provide a high lime content to the river sides. The marine depositions also provide a clay soil which holds the lime along the watercourses. In the extensive interraparian areas the flat clay expanses prevent downward infiltration of rain water and surface drainage. As a result the nutrients available in the large bogs come mainly from rain water and are hence deficient (ombrotrophic). The process of humification is minimal as the vascular plants of the bogs are mostly woody and evergreen, and therefore highly resistant to biodegradation in such cold climates. This persistence of vegetation and the longevity of the dominant forest species, provide evidence of previous watercourses, overflow patterns near the Mattagami River, and flow patterns within the bogs. The growing season for trees at this latitude (51^{o}N) is very short because of the influence of the prevailing winds from the cold waters of James Bay. The mean annual length of the growing season in the Onakawana area is 145 days, as compared to 210 days in Essex and Kent Counties in Southern Ontario. The mean annual snowfall is 112 inches, mean annual precipitation is 31 inches, and the mean daily temperature for January is -5^{o}F. (Chapman and Thomas, 1968). Despite these rigors the vegetation,

(5) Chapman, L.J., and M. K. Thomas (1968) The Climate of Northern Ontario.

particularly the vascular cryptogams, is verdant along the river banks. Within a half mile walk of the river banks one can traverse from rich boreal forests to large, wet areas of muskeg. (See Map 3). This apparent telescoping of the range of vegetational types, usually associated with latitudinal or altitudinal differences, is directly the result of differences between the minerotropic and well-drained riparian slopes and the poorly-drained acidic bogs.

The mean daily temperature for July is 61°F. and in the second week of August a temperature range from 19°F at night to 87°F in the daytime was recorded. This range exerts no detrimental influence upon the native vegetation although it seemed to encourage a premature production of anthocyanin and other fall pigments in some of the "exotic" species found on disturbed habitats.

Vegetation Types

Forest types have been adopted from Hustich (1955)[5] and are as follows:

1. Black spruce muskeg
2. Mixed feather moss forest
3. Rich white spruce forest (with the addition of native riparian associations)
4. Disturbed land and secondary balsam poplar-aspen forests of cut areas.

These zonations all belong to wet forest types (see Map 4).

1. Black spruce muskeg: This zone is best characterized by the presence of a limited number of species, all adapted to and suppressed by a distinctly ombrotrophic nutrient cycle. Black spruce dominates at heights of less than 25 feet and is in no way a

(6) Hustich, I. (1955), Forest Botanical Notes from the Moose River Area.

marketable tree (density is estimated at 194 per acre). In the saturated central areas of the interriparian pans, the incidence of black spruce deteriorates to 109 per acre or less.

The heights of black spruce in these saturated mires are about six feet or less. The black spruce often appears clumped and clone-like because submerged branches reappear from the sphagnum at a distance from the main trunk and assume the upright profile of an independent tree. Hustich (1955) concluded from work further north at Moose River Crossing and Renison that the peat grows 1/3 to 1/2 inch a year, whereas the annual shoots of the black spruce seedlings seldom exceed one inch growth per year. As the earlier annual shoots decay, the adventitious roots move higher, thus making true age determinations of seedlings very uncertain. The growth of mature black spruce for the year 1972, was estimated at the end of the growing season, around August 20, as 1.5 inches.

In these areas traverse by foot is virtually impossible. Sundew-pitcher plant associations indicative of a nitrogen deficiency are not infrequent.

The vegetation of the black spruce muskeg type is listed in Appendix I. Most of the evergreen and ericaceous plants of the area subsist on the minimal nutrient content of the surface water of these bogs and when they decay they contribute a minimal sum of nutrients.

Flow patterns are apparent throughout the black spruce muskeg. It is conjectural as to whether these are due to the glacial deposits of

melt streams, as would seem possible from their north to south flow patterns, or from alluvial deposits laid down in the past by winding rivers and streams. This could be tested through observations taken during excavation and drilling operations. They represent variations of the materials beneath the muskeg that make nutrients more available to the vegetation. These flow islands are characterized by vegetation similar to that of the transitional zone between the wet black spruce muskeg and the mixed feather moss forest of the better drained areas. Ericaceous shrubs dominate the sphagnum, and fruit much more than on the wet bogs. Better drainage is evidenced in the dry pits surrounding the trunks of black spruce. The pits are covered with lichen (Cladonia rangiferina) and cloudberry (Rubus chamaemorus).

In the transitional zones adjacent to rivers the sphagnum is penetrated with Carex sp. The ericaceous plants provide a consistent, although poor shade cover over the sphagnum. The glanded birch (Betula glandulosa) and willow species are abundant about the lichen covered spruce. Larch is present, but because of their devastation by larch sawfly in 1905 there are few large specimens. This fact indicates the persistence of the effects of disturbances on the vegetation. This observation is reenforced by the fact the line of a fire that apparently occurred in the early part of the century is still obvious through the muskeg between the Onakawana River and Medicine Creek.

The distinction between the black spruce muskeg zone and that of the mixed feather moss forest is a rather tenuous one maintained as it is only by the arbitrary criterion of a height of 25 feet for black spruce. The difference is the transition between an area of stagnant surface water to one of progressively more effective drainage slopes, from one with only a minimal availability of minerotrophic nutrients and organic matter to one with areas of nutrient contributing moraines and a considerable production of organic materials and one from a black spruce-sphagnum complex to a black spruce-moss-fir-white spruce forest.

2. Mixed feather moss forest: In areas furthest from the rivers, the mixed forest is swampy, with standing water gathered in pools. The black spruce is from 25 to 40 feet in height and is interspersed with the occasional larch, balsam poplar, white spruce and balsam fir. Few of the trees exceed six inches in diameter at breast height and most are around five inches. These trees, augmented by an eight-foot canopy of speckled alder (Alnus rugosa), cast a heavy shade over most of the ground. The principal species identified in this forest type are listed in Appendix II. More than 120 species were collected from this and the richer white spruce forest. A complete check list of the plants of the areas is being prepared.

3. White spruce forest: This type is found along the riparian terraces. It has been heavily logged in this area: a sawmill on the Onakawana River at Mile 126 produced mine props in

the 1940s. As most of the white spruce was removed the balsam poplars have attained considerable sizes. Aspen, white birch, balsam fir, larch and black spruce occur, but not in sufficient quantity or quality to warrant a profitable lumbering operation. The principal species identified in this forest type are listed in Appendix III.

4. Disturbed Areas: On the lower Onakawana, Medicine Creek and the Abitibi River, logging has resulted in a secondary forest of white birch, balsam poplar and trembling aspen. Native species such as Salix spp. and Cornus stolonifera typically dominate the shores although a few "exotics" appear also. The river banks have been included with other disturbed vegetation because of the incidence of species primarily of southern occurrence. Their appearance at Onakawana may be due to transportation by river currents or accidental introduction during railroad or early mining activities.

Other "disturbed" areas are the ditches leading from the railroad towards the Abitibi River. They appear to have served their purpose of draining the banks of the railway; one may deduce this from the improved growth of black spruce within a four foot margin on either side of the ditches. These ditches have not been kept clear and have become congested and waterlogged, providing neither drainage nor growth incentive, and as a consequence, at many locations the black spruce, whose growth had once been accelerated, has died. Species in these areas are listed in Appendix IV.

Research has been done in the Wade Lake area near Cochrane, on the improvement of muskeg forest growth with ditches. Growth seemed to have been stimulated for only three feet on each side of the ditch. Research in Finland, however, demonstrates that with proper management of the ditches profitable forests can be created in muskeg areas. The strip mining method suggested by the mining company, if properly handled, might drain the interriparian areas and provide the basis for a productive re-planting of the area. This would, hoever, be contingent upon the formation of a topography which would provide relatively high, well drained areas interspersing the drainage systems.

Vegetation along the Mattagami River near the southwestern corner of the site shows evidence of overflow patterns, indicating that the Mattagami River has overflowed in the past. At times, the Mattagami is probably a seasonal source of Medicine Creek which has its headwaters within a quarter mile of the river.

Even the oldest spoil piles beside the old excavation pit near the Abitibi River have a vegetation cover of no more than ten per cent. The species that have been doing reasonably well are not those which might contribute the necessary organic material to encourage the succession of surface covering species. Slumping of the sides of the heaps and exposure of the plant roots through runoff also discourage vegetation. It may be advantageous to spread the organic material from the strip being excavated on top of the areas already refilled. Use of the organic material as mulch would aid in preventing erosion and also provide seed and transplanted material which

would accelerate the colonization of the area. Woody ericaceous species, shrubs and trees would not contribute organic material for many years. Those species now growing on the slag heaps are horsetail, timothy, dandelion, evening primrose, clover, white melilot, squirrel-tail grass and knot weed. Balsam poplar, goldenrod and orchids appear occasionally. It might prove worthwhile to seed the existing spoil heaps with quantities of seed of these species in order to evaluate their performance as a reference for future recovery of mined areas. Plants such as clovers, statoniferous and creeping species such as Ronunculus cymbalaria and Fragaria vesca could be seeded as they are native to the area and are good surface covering species.

Introduced species which are doing well along the disturbed slopes adjacent to the railway are vetch, common plantain, savory, bedstraw, willow, crowfoot, white daisy, goldenrod and fireweed. These species may be considered for introduction to recovered areas.

It should be recognized that the suggestions being made regarding future floral recolonization of the excavated area are based on the need to limit erosion and to provide as pleasing an aspect as possible. The vegetation has no demonstrable economic value with the possible exception of improving habitat for wildlife populations following completion of the development.

Section II - Reptiles and Amphibians

The eastern garter snake (Thamnophis sirtalis sirtalis), the wood frog (Rana sylvatica) and the common toad (Bufo Americanus) were the only species of reptiles and amphibians recorded in the study area. Beals (1968)(6) states that the wood frog is "an abundant, widespread and successful species". During field trips to Onakawana, eastern garter snakes and wood frogs were observed only occasionally, suggesting low populations of these species. On sunny days a sizeable population of toads was observed.

To properly assess these populations the site would have to be examined in the early summer.

'7) Beals, C.S. (1968), Science History and Hudson Bay.

Section III - Fish

Abitibi River and Test Pit

The Abitibi River at Onakawana is shallow with a width of 75 to 150 yards at low flow. The river bed consists of many boulders and gravel bars. The river banks are from 20 to 40 feet in height and consist of a sand-clay till. The water level is approximately 10 feet higher during the spring runoff than in the summer. There appears to be considerable erosion of the banks in the spring and ice gouges can be seen 10 to 15 feet above the summer water level. The river carries a fine particulate sediment which in combination with the turbidity reduces visibility to six to eight inches.

The flow of the Abitibi River is regulated by the Otter Rapids power dam upstream from Onakawana. This results in a diurnal fluctuation of 2.5 to three feet during the summer months. When the water level is low, a third to half the river bed becomes exposed and becomes unsuitable as habitat for aquatic organisms. The fluctuations tend to cause a concentration of the sediment load. Temperature fluctuations are greater than normal.

The water temperature varied from 16° to 19°C and the dissolved oxygen concentrations from 7 to 10 ppm. A single B.O.D. sample yielded .6 mg. per litre. These samples were taken at the Federal gauging station (Onakawana). In the Abitibi River near Onakawana no aquatic vegetation was evident except for cattails and some grasses at the high water mark.

The test pit is about one acre in area and some 30 feet in depth. It is isolated from the Abitibi River by a clay dike 20 to 30 feet in width. The dike maintains the water level of the pit six feet above the summer level of the Abitibi. The test pit was dug to remove a quantity of lignite for drying tests. The lignite removed was stockpiled on the edge of the pit so that the water in the pit is derived partially from seepage through the lignite bed and the lignite stockpile. The main source of the water for the pit is the Abitibi River which floods the pit during the early spring, allowing fish to enter it.

A four-inch and a 2 1/2-inch mesh net were set for a total of four days in the Abitibi River during the first week of September. The nets were set for an equal length of time in the mainstream and in a backwater of the river. Total fish caught were four white suckers (Catostomus commersonni), one northern redhorse sucker (Moxostoma macrolepidotum) and one yellow walleye (Stizostedion vitreum vitreum).

A 2 1/2-inch mesh gill net was set in four locations in the pit, for a total of seven days during the last week of September and the first week of October. Fish species taken from the pit were 16 northern pike (Esox lucius), one white sucker, three northern redhorse suckers, and five longnose suckers (Catostomus catostomus).

One hundred man-hours of fishing with rod and reel yielded five yellow walleye (1 to 4 lb.) and one two-lb. pike. Hand nettings from the Abitibi River and test pit yielded white sucker, logperch (Percina caprodes), Johnny darter (Etheostoma nigrum), leaches, snails, crayfish (Orconectes propinquus), water boatmen, crane fly, and caddis flies (Lepidostomatidae and Hydropsychidae).

The Ministry of Natural Resources reported that sport fishing in the stretch of the Abitibi River from Coral Rapids to the Moose River was very poor. Local residents reported a yellow walleye run in the spring at the junction of the Abitibi and Onakawana Rivers. There have been some reports of trout at the mouth of Medicine Creek in the spring which could mean that trout utilize the Abitibi River although the Ministry of Natural Resources reported that sea run trout do not migrate past the Kwataboahegan Rapids, 50 miles downstream. Sturgeon have been found in the test pit at Onakawana, providing proof of a sturgeon population in the Abitibi River. The Commercial Fisheries Branch (M.N.R.) stated that past evidence indicated that a sturgeon fishery may be possible downstream. At the present time, however, the most northerly fishery on the Abitibi River is located just north of Fraserdale.

Onakawana River

The Onakawana River is a minor tributary of the Abitibi River. The river has its headwaters in the Canadian Shield in the vicinity of Fraserdale and flows approximately 60 miles to enter the Abitibi River five miles below Onakawana. The river bed is composed of stretches of fine clays, sand and boulders. The banks are of a sand-clay composition from 10 to 20 feet in height and show the marks of spring erosion and deposition on the meanders. During spring runoff the water level is approximately four to six feet higher than the summer flow and ice damage to trees was measured seven to eight feet above the summer level.

The river south of the site is open with a few rapids, while north of the site it is shallow and rocky. Although the water is clear, with visibility to six feet, there is little vegetation growing in the Onakawana River. Small patches (two to three square feet) of water weed (Hippuris vulgaris) are present as well as arrow-head (Sagittaria sp.) and cattails along the edge in backwater areas.

Water samples were taken at the old sawmill site, one mile upstream, and at the O.N.R. bridge crossing downstream from the site. Temperatures ranged from 15° to 19°C and dissolved oxygen concentrations ranged from nine to twelve ppm. A sample taken by the old sawmill resulted in a B.O.D. of .4 mg. per litre.

Gill nets (mesh sizes 4, 3 1/2 and 2 1/2 inches) were set in the Onakawana River for a total of 100 hours throughout the month of August. Three different habitats were sampled -- a deep pool, a shallow riffle and in midstream. Fish netted were 15 white suckers, 16 yellow walleye, five northern pike (Esox lucius) and three lake sturgeon (Acipenser fulvescens).

A one-inch mesh monofilament gill net was set for a total of five days during the first week of October. The net was set in two habitats -- a deep pool and in midstream. Four white suckers and seven northern pike were caught.

Fifty man-hours of fishing with a rod and reel resulted in a catch of a one pound northern pike. Hand nettings in the Onakawana River yielded white sucker, blacknose dace (Rhinichthys atratulus), trout-perch (Percopsis omiscomaycus), Johnny darter, sculpin (Cottidae), snail, crayfish (Orconectes virilis and O. propinquus), mayfly (Stenonema sp. and Heptagenia sp.), stone

fly (Nemouridae), midges (Chironomidae) and caddis fly houses. It should be noted that there is a large population of crayfish in the river.

The Cochrane District Office of the Ministry of Natural Resources stated that there is a good trout fishery on the Onakawana River in the vicinity of Coral Rapids, and that while there are pike and walleye present in the lower portion of the river the fishery is poor in the vicinity of the lignite deposit. A local resident from Moose River Crossing reported catching trout by the old sawmill during the winter and early spring.

Mattagami River

In the vicinity of the Onakawana lignite deposit the Mattagami River has a greater flow than the Abitibi. The river bed is composed of sand and boulders, and the clay-sand till banks reach a height of 15 to 50 feet. During the spring runoff the water level of the river is approximately 10 feet higher than the summer flow. The operation of three power dams on the Mattagami River in the vicinity of Smoky Falls cause fluctuating water levels. The river has a large number of sand banks and spits which appear to be laid down in the spring and then gradually eroded throughout the year.

Three water samples were taken from a 15-mile stretch of the Mattagami River in the section opposite the lignite bed. Temperatures varied from 18° to 20°C and the oxygen concentration ranged from 10 to 11 ppm. The river had a large quantity of filamentous algae (Cladophera sp.) growing in it during August.

Two gill nets (3 1/2 and 2 1/2 inch mesh) were set in the Mattagami River for a total of 80 hours. The nets were set in a backwater and in the mainstream and 11 white suckers, five northern redhorse sucker, three yellow walleye and one northern pike were taken. Hand nettings from shallow waters yielded yellow perch (Perca flavescens).

The Commercial Fisheries Branch of the Ministry of Natural Resources reported that there was a substantial sturgeon population in the Mattagami River. This population has been exploited in the past but there is no commercial fishery in this area now.

Medicine Creek

Medicine Creek rises from a pothole in a patch of wet muskeg and flows approximately 25 miles to the Abitibi River. The creek is slowly filling in with vegetation and in some areas takes on the appearance of a braided stream. Beaver dams, both old and new, block off the creek.

Two water samples were taken from Medicine Creek, one opposite Onakawana and the other from the Ontario Northland Railway bridge crossing. The temperatures recorded were 19.5° to 17°C and the oxygen concentrations were eight to six ppm. Visibility in Medicine Creek is limited to one foot. A 3 1/2 inch mesh gill net was set for 16 hours, and two white suckers were the total catch.

Local residents reported catching medium sized pike in the section of Medicine Creek just south of the railway bridge. They reported as well that in the spring of 1972 some trout were taken as they moved up the creek; this was the first time trout had been caught in Medicine Creek.

Discussion

The development of the Onakawana lignite deposits could affect the rivers and streams in the following manner: Abitibi River -- thermal effects, effect of a damp and pump water; Onakawana River -- effect of diverting 4.5 to 6 miles, and pump water; Mattagami River -- effect of pump water; Medicine Creek -- effect of draining the headwaters and pump water. The Abitibi and Mattagami Rivers are both detrimentally affected by the large fluctuations in their water levels caused by hydro dams upstream.

It appears from work done to date and from interviews carried out that none of these waters have a significant fish population to be affected by the development but further studies will be required before a fully reliable statement as to fish populations can be made.

The lack of information on the biology of these waters, especially the Abitibi River makes further work necessary before the impact of the proposed development can be properly judged: pre-engineering studies such as those being carried out at Ontario Hydro's proposed development of the Wesleyville and Lennox Generating Stations will have to be carried out. The bottom fauna, fish population and distribution and spawning grounds, weed growth characteristics, and water quality throughout the year should all be studied in order to accurately predict the effects of the proposed development on the Abitibi River. It is not suggested that these studies be carried out before the environmental feasibility or engineering feasibility of the development is decided upon, but they should be carried out before the final engineering of the plant is completed. This would allow the engineers to properly design the cooling water system so that damage to the river does not occur.

Section IV -- Birds

Waterfowl

The species recorded in the Onakawana area were the Canada goose (Branta canadensis), the common merganser (Mergus merganser), and the following species of ducks: black (Anas rubripes), redhead (Aythya americana), canvasback (Aythya valisineria), scaup (Aythya spp.) and common goldeneye (Bucephala clangula). While ducks appeared to be utilizing this area principally during migration, the remains of a black duck nest were found in August near the Onakawana River. Most waterfowl were concentrated along the Abitibi River, but smaller numbers of black ducks were found from the Onakawana River west to the Mattagami River. It should be noted that records of waterfowl were taken primarily near the Abitibi River and areas west of the Onakawana River were surveyed infrequently. On August 13 and 14, 1972, two common mergansers, two redheads and two black ducks were recorded at Medicine Creek. Whether these were mating pairs is not certain. Seven flocks of Canada geese and small flocks of ducks were seen flying southward in the weeks of September 25 to October 10, 1972.

The Onakawana area probably does not have much importance for breeding or migrating geese and ducks. There appears to be a lack of suitable breeding habitat and during migration flocks settle into this area only because of adverse weather conditions. No important flyway is evident although still unsubstantiated data indicate that brant (Branta bernicula) may use the Abitibi drainage during fall migration.

Upland Game Birds

Ruffed grouse (Bonasa umbellus) and spruce grouse (Canachites canadensis) were the only species of upland game birds recorded in the Onakawana area. Ruffed grouse were found from the Abitibi River west to the Medicine Creek area. Spruce grouse were recorded from the Abitibi River to the O.N.R. tracks and from the Onakawana River to Medicine Creek. Their numbers appeared to be low. More grouse were recorded in September and October than in August, probably because of changes in cover, feeding and nesting habits and the dispersion of family units.

No sharp-tailed grouse (Pedioecetes phasianellus) were recorded in the area. The Ministry of Natural Resources, reports that sharp-tailed grouse were sighted in the vicinity of the O.N.R. tracks near Mile 124 and in recent years sharp-tailed grouse were plentiful in the area. Periodic fluctuations in the numbers or migrations of this species have been recorded for most of northern Ontario and apparently this year was a "low".

Spruce and ruffed grouse are scattered in relatively small numbers throughout the area and would not appear to be endangered by the proposed development. Previous records (H. Lumsden, personal communication) indicate the possibility of sharp-tailed grouse "dancing grounds" near Mile 125. Yearly fluctuations in the numbers of grouse make it difficult to determine the actual utilization of the area.

Non-game Birds

A list of birds identified in the Onakawana area is given in Appendix V, together with identification of some species, based on limited observations. Sandpipers (Scolopacidae), nighthawks (Chordeiles minor),

swallows (Hirundinidae), cedar waxwings (Bombycilla cedrorum), warblers (Parulidae), and sparrows (Fringillidae) which were seen frequently during August had migrated out of the area by the second survey in late September and early October. Thicker forest growth and vegetation zones along the rivers and streams provide a more varied habitat and more species of birds were observed in these areas than in the more open muskeg zones.

Disruption of the vegetational zones, which will result from development at Onakawana, will eliminate or severely reduce nesting and feeding habitat for many species of birds and will cause a change in the present population in the immediate area. Proper rehabilitation of the area may, however, provide habitat which will increase the diversity of species and total numbers of birds.

Section V - Mammals

A list of mammals observed in the Onakawana study area during the two field trips is presented in Appendix VI.

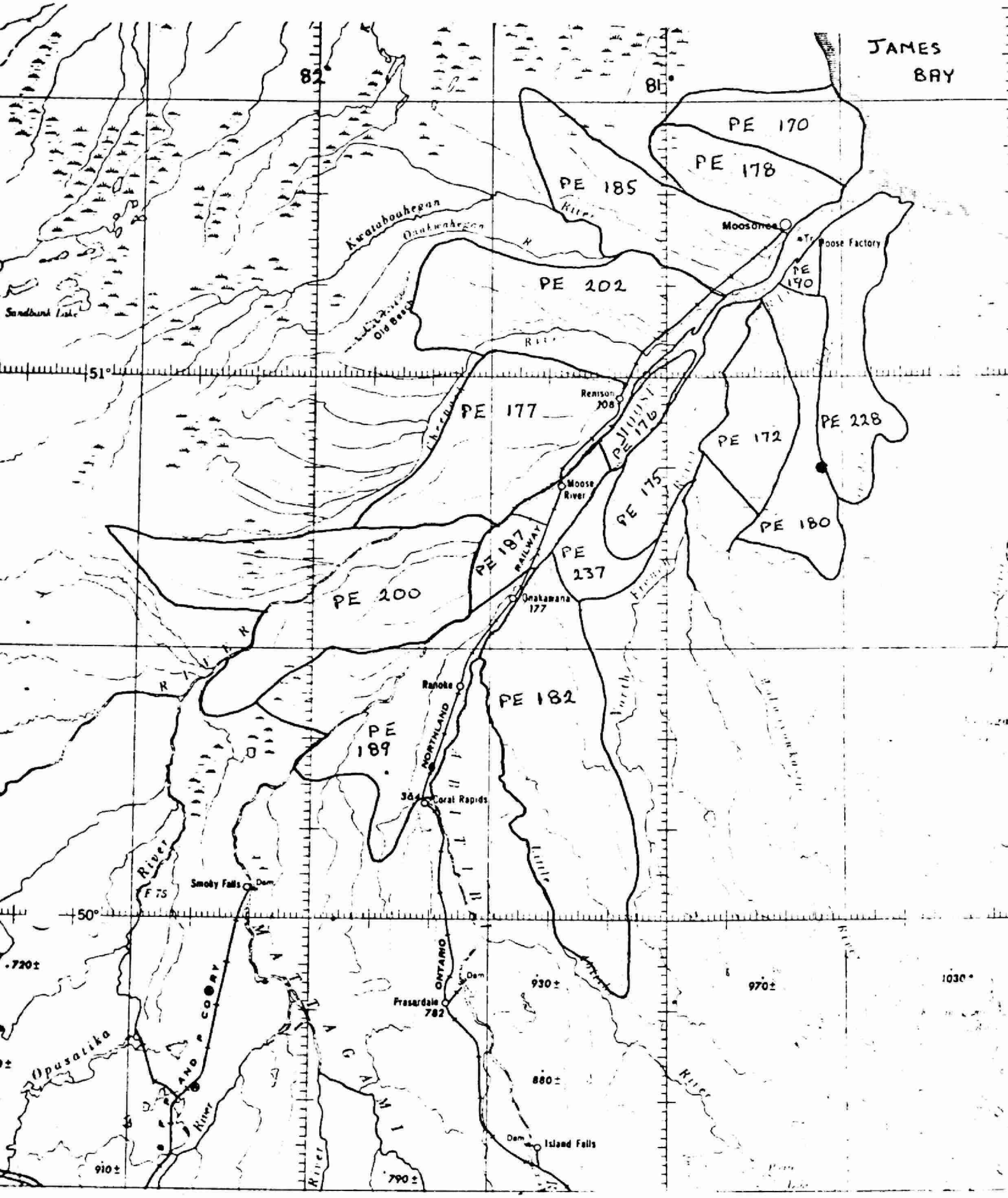
Furbearers

Fur bearing mammals observed in the study area include beaver (Castor canadensis), muskrat (Ondatra zibethica) and otter (Lutra canadensis). The presence of beaver was recorded by direct observation, tracks, freshly cut trees or other vegetation, dams and lodges. Beaver ranged from the Abitibi River to the Mattagami River. Muskrat were observed from the Abitibi River, west to the Onakawana River and otter were found primarily on the Onakawana River.

Trapper returns from the Ministry of Natural Resources' files provide catch data of furbearers by trapline. Data have been collected for the 16 traplines which are within the general area of Onakawana (see Map 5). The data, as shown in Appendix VII cover a ten year period from the 1958-59 season to the 1967-68 season. A new computerized system is being developed to record trapper information so data for the most recent seasons are not yet available.

Two traplines, PE 187 and PE 189, will be the most directly affected by any development in the Onakawana area. Trapline PE 187 was vacant for four years of the 10 year data period and very lightly trapped two other years. It should be realized that catch data indicate only the actual utilization of the resource. Several factors, such as weather conditions, availability of work elsewhere for the trappers and the population density of animals, affect

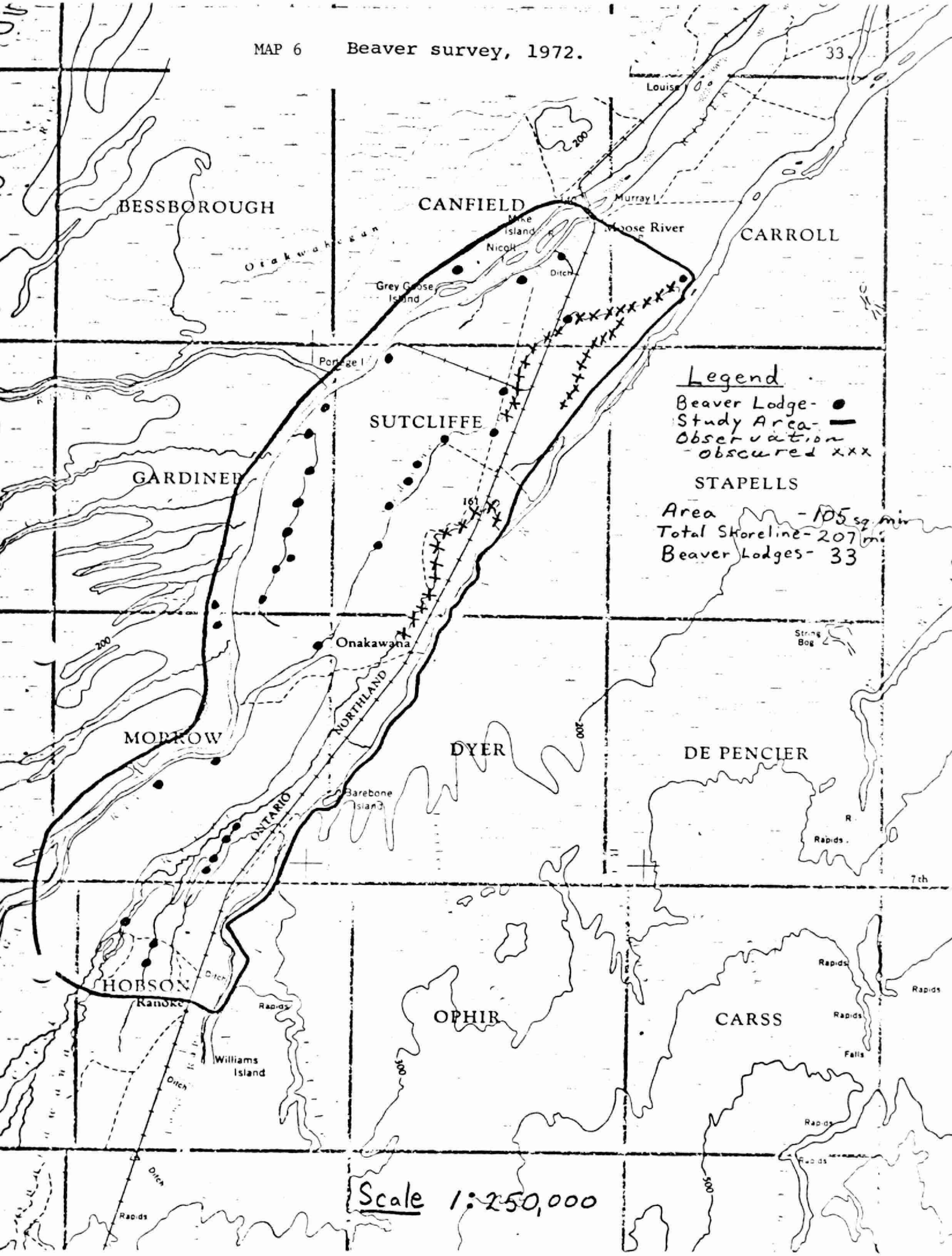
Map 5 Registered traplines in the Onakawana area.



the effort and success reflected in the trappers' returns.

In August, 1972, the field party at Onakawana met Mr. Tozier, who has had the trapping licence for PE 187 for the past four years. He made the comment that this trapline had been trapped out in previous years, but after being left idle for a few years appears to be coming back. Mr. Tozier reported his catch for the 1971-72 season as 24 beaver, 67 marten (Martes americana), 12 mink (Mustela vison), 8 otter and 6 red fox (Vulpes fulva). He estimated the value of the catch from this trapline at $2,500 to $3,000 for the year.

An aerial survey of beaver populations was conducted on October 7, 1972. Within the area, as shown on Map 6, there were 207 linear miles of stream or river banks. Along these were 33 beaver lodges for a ratio of lodges per miles of shoreline of 1:6.3. However, water level fluctuations on the Abitibi and the Mattagami Rivers result in unsuitable habitat for beaver, so an adjustment has been made using only data from smaller rivers and creeks. Suitable beaver habitat occurs over a shoreline length of 93 miles, and the adjusted ratio of lodges per mile of shoreline is 1:2.8. To put this in perspective the index of population density is compared in Table 1 to that for Patricia West area (Sioux Lookout District), where standard plots in muskeg habitat have been surveyed for bearer populations over many years. Considering only shorelines of suitable beaver habitat, both areas had comparable ratios of the number of beaver lodges to miles of shoreline, Onakawana and Patricia West having a ratio of 1:2.8 and 1:2.5 respectively. However, consideration should be given to drainage patterns of each area.


MAP 6 Beaver survey, 1972.
BESSBOROUGH
CANFIELD
CARROLL
SUTCLIFFE
GARDINER
STAPELLS
MORROW
DYER
DE PENCIER
HOBSON
OPHIR
CARSS
Onakawana
Barebone Island
Williams Island
Grey Goose Island
Mike Island
Nicolt
Ditch
Murray I.
Moose River
Louise
Portage I.
String Bog
Rapids
Falls
NORTHLAND
ONTARIO
Legend
Beaver Lodge-
Study Area-
Observation - obscured xxx
Area - 105 sq mi
Total Shoreline - 207 mi
Beaver Lodges - 33
Scale 1:250,000

The Patricia West area is a wetter site and therefore has a higher productivity per square mile. The densities of beaver colonies in the Onakawana area compare favourably with the more southern regions of Ontario.

Table 1. Area surveyed, miles of shoreline and beaver population densities in muskeg habitats in Patricia West and Onakawana

	Patricia West	Onakawana Area
Area (sq. miles)	52	105
Shoreline (miles)	166	93
Miles of shoreline in relation to sq. miles of land	1:0.3	1:1
Number of lodges	66	33
Lodges per mile of shoreline	1:2.8	1:2.5

If future development at Onakawana involves drainage of Medicine Creek and/or diversion of the Onakawana River, then any aquatic mammals in those areas will be displaced. In all likelihood suitable sites in adjacent areas are already occupied and movement into these areas by displaced animals will put pressure on the indigenous population.

Big Game

Big game animals were recorded from direct observation, tracks, droppings and other evidence which indicated their presence in the area. Big game species found in the area were moose (Alces alces), woodland caribou (Rangifer caribou) and black bear (Ursus americanus).

Moose

Sightings and tracks of moose were recorded from the east bank of the Abitibi River to the east bank of the Mattagami River within the study area, but they were infrequent and widespread, indicating a low population. The general feeling of the local people was that the moose population was low in the area. Consideration should be given to the time of year this survey was done (i.e., August, September and October). Moose may not be distributed during this season as they are in late fall or winter and any estimates of numbers within the area are, therefore, not conclusive.

Winter moose surveys conducted in past years by the Ministry of Natural Resources show low moose populations in the Onakawana study area. Wolfe (1970)[7] suggests that the area "is an inaccessible area of low moose density that is very lightly hunted", and he considers it to be outside the normal moose range of the district. If the proposed mining operation goes ahead the "resident" moose will be displaced to areas outside the Onakawana site. The question arises as to whether these moose can find suitable unoccupied habitat in adjacent areas. Range outside the Onakawana site may

(8) Wolfe, M.R. (1970), Aerial Moose Survey, Cochrane District.

already have a population pushing the carrying capacity to the limit. If so, then movement of moose from Onakawana into adjacent areas might disrupt existing distributions over relatively wide areas. As the numbers of moose involved is so small this situation will probably quickly rectify itself. If the spoil piles are properly reclaimed the carrying capacity for moose should be increased.

Woodland caribou

The Onakawana area is situated in the Eastern Swamp Region of the woodland caribou range. This area is poor winter range for caribou, but provides good summer range where tamarack swamps are present (Ahti and Hepburn, 1967).(8) The carrying capacity for the Eastern Swamp Region is estimated at approximately seven caribou per 100 square miles. However, caribou populations have not reached the carrying capacity in this area.

Woodland caribou or their tracks were recorded in the area west of the Onakawana River to the Mattagami River and seemed to be limited to this particular area. The only sighting was a herd of five animals (four adults and one calf), between Medicine Creek and the Mattagami River. Because caribou migrate the proposed mining operation at Onakawana may present a barrier to their movements. Experience in other areas of the province shows that this will probably not be a problem.

The strip mining of the lignite deposits would temporarily remove an area of up to a maximum of twenty square miles from the caribou range.

(9) Ahti, T. and Hepburn, R.L. (1967), Preliminary studies on woodland caribou range, especially on lichen stands in Ontario.

As with the moose population though, the rehabilitated spoil piles would most probably provide better caribou habitat than presently exists.

Black Bear

Black bear sightings, tracks or droppings were recorded from the Abitibi River, west to the O.N.R. tracks and from the Onakawana River, west to the Mattagami River. Evidence of bears near the Abitibi River was concentrated around Manalta's garbage dump which appeared to attract bears into the area. The number of bears in other areas apparently was low, compared to the overall size of the sample area. The future development of the site probably would not endanger bear populations.

Predators

Predatory animals recorded in the sample area were the timber wolf (Canis lupus) and red fox (Vulpes fulva).

Timber Wolf

Sightings, tracks and droppings of wolves were evident from the Abitibi River, west to Medicine Creek. However, the population is probably not as high as that in more southern parts of the province where food is more abundant. A local resident reported two mating pairs in the general area of Onakawana.

Red Fox

Evidence of red fox was found in an area from the Abitibi River, west to the Onakawana River. The density of fox populations is also difficult to assess. However, there is a relatively large food source available for foxes in the area and they undoubtedly exceed the numbers of wolves.

Development of the Onakawana site will indirectly affect the existing wolf and fox populations. These animals rely on moose, caribou, smaller animals and vegetation for their existence. Displacement of the prey means displacement of the predators to other areas where they must compete with others of their kind for food and space.

Other Mammals

Other mammals found in the area were porcupine (Erethizon dorsatum), snowshoe hare (Lepus americanus), red squirrel (Tamiasciurus hudsonicus), least (Mustela rixosa) and shorttail weasel (Mustela erminea), deer mice (Peromyscus maniculatus), masked shrews (Sorex cinereus) and meadow voles (Microtus pennsylvanicus). These mammals were sparsely distributed throughout the area. Generally their populations are low, except for the red squirrel which appears to be well established in most areas. The population censuses, however, cannot claim great accuracy. A survey under winter conditions would allow track censuses to be made with greater accuracy as to species and numbers than is the case in the August/September period when this survey was taken.

DISCUSSION

The series of reports on the biology of the Onakawana area which have been presented represent an attempt to come to grips in a short time with the basics of a complicated system. Field workers who took part in the study performed competently and professionally but no responsible biologist or ecologist would accept such reports as the bases for decision-making. There are two great gaps in the information:

1. The time and effort allotted for field work did not allow an adequate inventory of the biological components of the area. This is particularly evident when we consider that inventory was confined to relatively short periods during late summer and early fall. What the situation may be in late fall, winter, spring and early summer cannot be projected from the available data.

2. There has been no opportunity to assess the interrelationships of the biological elements of the area. Reference has been made in several instances to the possible effects of displacing mammals and, subsequently, their movements to adjacent areas. However, the truth is that no one knows for certain what the results may be; the extent of the area which may be influenced, the primary, secondary, tertiary -- effects, etc. Nevertheless, in many ways I consider the terrestrial ecosystem to be more predicatable and easier to understand than the aquatic one. The very nature of the aquatic environment almost ensures that major changes will occur in very basic elements of the system in areas well removed from the actual scene of the operations.

We are, therefore, not merely judging the environmental acceptability of a hole in the ground or the construction and operation of a power plant.

I am not satisfied with completeness of the data or the total of research and investigation relative to biological studies. It is evident, from preliminary surveys, that the ecosystem of the Onakawana area is not adequately known. Intensive investigations of all elements of the environment are required and must be related to the proposed method of operation of the mining and power generating complex at Onakawana before any firm decision is made about the acceptability of the proposed operations.

LIST OF APPENDICES

Principal Species of Black Spruce Muskeg

(A) Dominant:

Black Spruce	*Picea mariana*
Labrador Tea	*Ledum groenlandicum*
Sedge	*Carex limosa*
Sedge	*Carex trisperma*
Sedge	*Carex disperma*
Sedge	*Carex rostrata*
Cotton Grass	*Eriophorum angustifolium*
Cotton Grass	*Eriophorum spissum*
Sphagnum Moss	*Sphagnum* sp.
Cloudberry	*Rubus Chamaemorus*
Lichen	*Cladonia rangiferina*

(B) Scattered:

Tamarack	*Larix laricina*
Dwarf Birch	*Betula glandulosa*
Sheep Laurel	*Kalmia angustifolia*
Swamp Laurel	*Kalmia polifolia*
False Soloman's Seal	*Smilacina trifolia*
Leather Leaf	*Chamaedaphne calyculata*
Bog Rosemary	*Andromeda glaucophylla*
Club Moss	*Lycopodium clavatum*
Small Cranberry	*Vaccinium Oxycoccus*
Creeping Snowberry	*Gaultheria hispidula*

APPENDIX II

Principal Species of Mixed Feather Moss Forest

Black Spruce	*Picea mariana*
Tamarack	*Larix laricina*
Balsam Poplar	*Populus balsamifera*
White Spruce	*Picea glauca*
Balsam Fir	*Abies balsamea*
Smooth Alder	*Alnus rugosa*
Mountain Cranberry	*Vaccinium vitis-idaea*
Horsetail	*Equisetum sylvaticum*
Horsetail	*Equisetum arvense*
Leather Leaf	*Chamaedaphne calyculata*
Labrador Tea	*Ledum groenlandicum*
Cinque Foil	*Potentilla palustris*
Willow-herb	*Epilobium palustre*
Clubmoss	*Lycopodium annotinum*
Thistle	*Cirsium muticum Michx.*
Lettuce	*Lactuca* spp.

APPENDIX III

Principal Species of White Spruce Forest

Balsam Fir	Abies balsamea
Trembling Aspen	Populus temuloides
White Birch	Betula papyrifera
Tamarack	Larix laricina
Black Spruce	Picea mariana
Bunchberry	Cornus canadensis
Twin-Flower	Linnaea borealis
Miterwort	Mitella nuda
Horsetail	Equisetum sylvaticum
Horsetail	Equisetum arvense
Wild Sarsaparilla	Aralia nudicaulis
Lungwort	Mertensia paniculatum
Squashberry	Viburnum edule
Baneberry	Actaea alba
Baneberry	Actaea rubra
Dwarf Blackberry	Rubus pubescens
Cloudberry	Rubus chamaemorus
Swamp Red Currant	Ribes triste
Black Currant	Ribes nigrum
Currant	Ribes hudsonianum
Smooth Gooseberry	Ribes oxyacanthoides
Swamp Black Currant	Ribes lacustre
Prickly Gooseberry	Ribes cynobasti
Wintergreen	Pyrola asarifolia
Wintergreen	Pyrola minor
Wintergreen	Pyrola secunda
Meadow Rue	Thalictrum dasycarpum
Pearly Everlasting	Anaphalis margaritacea
False Soloman's Seal	Smilacina stellata
False Soloman's Seal	Smilacina trifolia
Aster	Aster spp.
Golden-Rod	Solidago hispida
Rattlesnake Fern	Botrychium virginianum
Fern	Dryopteris spinulosa vars.
Marsh Marigold	Caltha palustris
Rose	Rosa blanda
Rose	Rosa acicularis
Bedstraw	Galium spp.

cont'd.

APPENDIX III (Cont'd)

Chickweed Wintergreen	Trientalis borealis
Twisted-stalk	Streptopus amplexifolium
Willow-herb	Epilobium spp.
Water Avens	Geum rivale
Avens	Geum alleppicum
Milfoil	Achillea Millefolium
Goldthread	Coptis groenlandica
Balsam Poplar	Populus balsamifera
White Spruce	Picea glauca
Smooth Alder	Alnus rugosa
Mountain Cranberry	Vaccinium vitis-idaea
Leather Leaf	Chamaedaphne calyculata
Labrador Tea	Ledum groenlandicum
Cinquefoil	Potentilla palustris
Clubmoss	Lycopodium annotinum
Thistle	Cirsium muticum Michx.
Lettuce	Lactuca spp.

APPENDIX IV

Composition of Disturbed Land and Secondary Balsam poplar-Aspen Forests of Cut Areas

Willow	Salix spp.
Red-Osier Dogwood	Cornus stolonifera
Fern	Oxytropis campestris
Silverberry	Elaeagnus commutata
Pin Cherry	Prunus pennsylvanica
Pondweed	Potamogeton filiformis
Pondweed	Potamogeton pectinatus
Pondweed	Potamogeton crispa
Silverweed	Potentilla anserina
Carpenter-weed	Prunella vulgaris
Water Plantain	Alisma plantago-aquatica
Bur-reed	Sparganium sp.
Bulrush	Scirpus rubrotinctus
Common Horsetail	Equisetum arvense
Horsetail	Equisetum variegatum
Horsetail	Equisetum palustre
Horsetail	Equisetum fluviatile
Arrowhead	Sagittaria cuneata
Arrowhead	Sagittaria latifolia
Everlasting Pea	Lathyrus palustris
Cow Parsnip	Heracleum lanatum
Mint	Mentha arvensis
White Melilot	Melilotus alba
Squirrel-tail Grass	Hordeum jubatum
Knotweed	Polygonum lapathifolium
Timothy	Phleum pratense
Common Dandelion	Taraxacum officinale
Common Evening Primrose	Oenothera biennis
Alsike Clover	Trifolium hybridum
White Clover	Trifolium repens
Vetch	Vicia Cracca
Vetch	Vicia americana
Common Plantain	Plantago major
Savory	Satureja vulgaris
Bedstraw	Galium tetrahit

Cont'd.

APPENDIX IV (Cont'd)

Bristly Crowfoot	*Ranunculus pennsylvanicus*
White Daisy	*Chrysanthemum leucanthemum*
Golden Rod	*Solidago canadensis*
Golden Rod	*Solidago uliginosa*
Fireweed	*Epilobium angustifolium*
Shrubby Cinguefoil	*Potentilla fruticosa*
Field Sorrel	*Rumex acetosella*
Water Parsnip	*Sium suave*
Mare's-Tail	*Hippuris vulgaris*

APPENDIX V

Birds observed in the Onakawana area

	Abitibi R. to O. N. R.	O.N.R. to Onakawana River	Onakawana River to Medicine Cr.	Medicine Cr. to Mattagami R.
Great blue heron Ardea herodias *	X			
Canada goose Branta canadensis	X	X		
Black duck Anas rubripes	X		X	X
Scaup Aythya sp.*	X			
Common goldeneye Bucephala clangula	X			
Common merganser Mergus merganser	X		X	
Sharp-skinned hawk Accipiter striatus		X		
Marsh hawk Circus cyaneus	X	X		
Osprey Pandion haliaetus				X
Spruce grouse Canachites canadensis	X		X	
Ruffed grouse Bonasa umbellus	X	X	X	
Sandhill crane Grus canadensis	X		X	X
Semipalmated plover Charadrius semipalmatus	X			
Common snipe Capella gallinago	X			
Spotted sandpiper Actitis macularia	X			
Solitary sandpiper Tringa solitaria	X	X		
Herring gull Larus argentatus	X			X
Common nighthawk Chordeiles minor	X	X		
Belted kingfisher Megaceryle alcyon	X			
Yellow-shafted flicker Colaptes auratus		X		
Hairy woodpecker Dendrocopos villosus	X			
Downy woodpecker Dendrocopos pubescens	X			
Northern three-toed woodpecker Picoides tridactylus			X	
Olive-sided flycatcher Nuttallornis borealis		X	X	
Bank swallow Riparia riparia	X			
Gray jay Perisoreus canadensis	X	X	X	
Common raven Corvus corax	X	X		X
Common crow Corvus brachyrhynchos	X	X		
Black-capped chickadee Parus atricapillus		X		X

Continued .....

APPENDIX ('Cont'd)

	Abitibi R. to O. N. R.	O.N.R. to Onakawana River	Onakawana River to Medicine Cr.	Medicine Cr. to Mattagami R.
Boreal chickadee Parus hudsonicus	X	X	X	X
American robin Turdus migratorius	X	X		X
Veery Hylocichla fuscescens *			X	X
Cedar waxwing Bombycilla cedrorum	X	X		
Northern shrike Lanius excubitor *		X		
Black-and-white warbler Mniotilta varia		X		
Yellow warbler Dendroica petechia	X	X	X	X
Northern waterthrush Seiurus noveboracensis	X			
Wilson's warbler Wilsonia pusilla	X	X		
Brown-headed cowbird Molothrus ater *	X	X		
Savannah sparrow Passerculus sandwichensis		X		
Vesper sparrow Pooecetes gramineus		X		
Slate-coloured junco Junco hyemalis	X	X	X	X
Clipping sparrow Spizella passerina	X	X	X	
White-crowned sparrow Zonotrichia leucophrys		X		
White-throated sparrow Zonotrichia albicollis		X	X	
Song sparrow Melospiza melodia		X	X	

* Species that do not breed in the area, based on Godfrey, W.E. (1966), The Birds of Canada.

Tentative identification of birds sighted only once during the field trips.

	Abitibi R. to O. N. R.	O.N.R. to Onakawana River	Onakawana River to Medicine Cr.	Medicine Cr. to Mattagami R.
Redhead duck Aythya americana			X	
Canvasback duck Aythya valisineria	X			
Goshawk Accipiter gentilis		X		
Eagle (Golden) Aquila chrysaëtos	X			
Short-billed dowitcher Limnodromus griseus		X		
Winter wren Troglodytes troglodytes			X	
Hermit thrush Hylocichla guttata			X	
Harris' sparrow Zonotrichia querula		X		
Swamp sparrow Melospiza georgiana	X			

APPENDIX VI

Mammals Observed at Onakawana

Mammals	Abitibi R. to ONR Tracks	ONR Tracks to Onakawana R.	Onakawana R. to Medicine Creek	Medicine Creek to Mattagami R.
Moose Alces alces	X	X	X	X
Caribou (woodland) Rangifer caribou			X	X
Wolf (timber) Canis lupus	X	X	X	
Bear (black) Ursus americanus	X		X	X
Red fox Vulpes fulva	X	X		
Beaver Castor canadensis	X	X	X	X
Otter Lutra canadensis		X		
Muskrat Ondatra zibethica	X	X		
Porcupine Erethizon dorsatum			X	
Snowshoe hare Lepus americanus	X			
Red squirrel Tamiasciurus hudsonicus	X	X	X	X
Least weasel Mustela rixosa			X	
Shorttail weasel Mustela erminea		X		
Deer mouse Peromyscus maniculatus		X		X
Masked shrew Sorex cinereus		X		
Meadow vole Microtus pennsylvanicus	X			

APPENDIX VII

Fur catch / : sixteen traplines /

	1958-1959	1959-1960	1960-1961	1961-1962	1962-1963	1963-1964	1964-1965	1965-1966	1966-1967	1967-1968	Ten Year Total	Average
TRAPLINE PE 170												
Beaver	85	46	8	27	65	73	35	82	8	45	474	47.4
Fisher	3	1		1	1	1	1			1	9	.9
Fox-Arctic								1			1	.1
Fox-Coloured								1			1	.1
Lynx			1	2		3		6			12	1.2
Marten	2	2	2	12	2	10		22	38	1	91	9.1
Mink	33	39	42	25	10	9	9	28	3	14	212	21.2
Muskrat	13			3	11	4	2	8	8	60	109	10.9
Otter	5	7	7	7	3	6			3	4	42	4.2
Weasel	11	3	4	25		1	7			1	52	5.2
TRAPLINE PE 172												
Beaver	3		4	4		6	1	3		3	24	2.4
Fisher	1	2	1						V		4	.4
Fox-Arctic									A		---	----
Fox-Coloured							1	1	C		2	.2
Lynx			1						A		1	.1
Marten	9		19	15	23	14	20	30	N	1	131	13.1
Mink	24	24	38		2	7	5	11	T	1	112	11.2
Muskrat	24	9	39	17	42	92	23	28		4	278	27.8
Otter	1	3	3		1	1	1				10	1.0
Weasel	9	8	9	4	2	1	4	2			39	3.9

Continued.....

	1958-1959	1959-1960	1960-1961	1961-1962	1962-1963	1963-1964	1964-1965	1965-1966	1966-1967	1967-1968	Ten Year Total	Average
TRAPLINE PE 175												
Beaver	11	43		53	59	20	24	10	18	72	310	31.0
Fisher		1		2							3	.3
Fox-Arctic											---	----
Fox-Coloured	1										1	.1
Lynx		1			1						2	.2
Marten	7	21		32	51	44	18	58	69		300	30.0
Mink	17	31		11	9	11	12	4	1		96	9.6
Muskrat	30	23		56	77	75	37		22	50	370	37.0
Otter	7			6	4		1		1	4	23	2.3
Weasel	11	20		5	5	9	6	11			67	6.7
TRAPLINE PE 176												
Beaver	8	12	15	17	16	49		V	3	5	125	12.5
Fisher			1	1	1			A			3	.3
Fox-Arctic								C			---	----
Fox-Coloured								A			---	----
Lynx							1	N			1	.1
Marten	1	6	24	14	3	19	9	T		4	80	8.0
Mink	8	25	31	8	1	8	2			1	84	8.4
Muskrat	10	28		4	5	70				5	122	12.2
Otter	2		6	6	1	6				1	22	2.2
Weasel	7	8	11	2							28	2.8

Continued.....

	1958-1959	1959-1960	1960-1961	1961-1962	1962-1963	1963-1964	1964-1965	1965-1966	1966-1967	1967-1968	Ten Year Total	Average
TRAPLINE PE 177												
Beaver	40	8	37	85	65	71	51	9	6	56	428	42.8
Fisher	2		3		2				2		9	.9
Fox-Arctic											---	----
Fox-Coloured			1		2						3	.3
Lynx											---	----
Marten	4		24	15	32	55	62		13	6	211	21.1
Mink	5		33	15	5	4	8		1		71	7.1
Muskrat			4	37	24	56	22	10	35	55	243	24.3
Otter	1		3	3	3	6	1			2	19	1.9
Weasel	18		12	8	2	2	12		3		57	5.7
TRAPLINE PE 178												
Beaver	5	62	18	5	15	8	110	39	35	1	298	29.8
Fisher			2								2	.2
Fox-Arctic											---	----
Fox-Coloured					1						1	.1
Lynx		1		2	2		1				6	.6
Marten		3	3		1		1	11	61		80	8.0
Mink	3	26	22		3	1	20	11	2		88	8.8
Muskrat		5			8		28		42		83	8.3
Otter		3	5			1	3		1		13	1.3
Weasel	15	19	6				6	4			50	5.0

Continued.....

	1958-1959	1959-1960	1960-1961	1961-1962	1962-1963	1963-1964	1964-1965	1965-1966	1966-1967	1967-1968	Ten Year Total	Average
TRAPLINE PE 180												
Beaver	N	N	D		V	4	13	V		11	28	2.8
Fisher	O	O	I		A			A			---	----
Fox-Arctic			D		C			C			---	----
Fox-Coloured	R	R			A			A			---	----
Lynx	E	E	N		N			N			---	----
Marten	T	T	O	16	T	6	3	T	2	8	35	3.5
Mink	U	U	T	2		5				1	8	.8
Muskrat	R	R	TRAP			69	1		1	6	77	7.7
Otter	N	N				1				1	2	.2
Weasel				2					3		5	.5
TRAPLINE PE 182												
Beaver	N	33	D	26	29	26	12	V	V	V	126	12.6
Fisher	O		I		1	1		A	A	A	2	.2
Fox-Arctic			D					C	C	C	---	----
Fox-Coloured	R							A	A	A	---	----
Lynx	E		N					N	N	N	---	----
Marten	T	27	O	29	15	26	25	T	T	T	122	12.2
Mink	U	10	T	4	1	2	2				19	1.9
Muskrat	R	63	TRAP	13	18	27	4				125	12.5
Otter	N	1		5	2	1					9	.9
Weasel		5		2							7	.7

Continued.....

	1958-1959	1959-1960	1960-1961	1961-1962	1962-1963	1963-1964	1964-1965	1965-1966	1966-1967	1967-1968	Ten Year Total	Average
TRAPLINE PE 187												
Beaver	42	74	54	V	V	V	6	1	N	V	177	17.7
Fisher	1	4	1	A	A	A			O	A	6	.6
Fox-Arctic				C	C	C				C	---	----
Fox-Coloured				A	A	A			R	A	---	----
Lynx		1		N	N	N			E	N	1	.1
Marten		20	27	T	T	T		1	T	T	48	4.8
Mink	11	46	20					1	U		78	7.8
Muskrat	10	35					13		R		58	5.8
Otter	3	2	7						N		12	1.2
Weasel	9	23	5								37	3.7
TRAPLINE PE 189												
Beaver	45	N	V	6	97	63	37	6	30	51	335	33.5
Fisher	1	O	A			1					2	.2
Fox-Arctic			C								---	----
Fox-Coloured		R	A								---	----
Lynx		E	N			2			1		3	.3
Marten	1	T	T		61	29	58	31	97	11	288	28.8
Mink	13	U			12	8	9	4	2	4	52	5.2
Muskrat	9	R		4	44	40	35	2	3	5	142	14.2
Otter	2	N		1	1	2	2	1	3	3	15	1.5
Weasel							19		3	1	23	2.3

Continued.....

	1958-1959	1959-1960	1960-1961	1961-1962	1962-1963	1963-1964	1964-1965	1965-1966	1966-1967	1967-1968	Ten Year Total	Average
TRAPLINE PE 185												
Beaver	77	106	6	36	68	167	33	51	9	21	574	57.4
Fisher		1	1	1	1		2			1	7	.7
Fox-Arctic											---	----
Fox-Coloured											---	----
Lynx		4		3	5	2	2				16	1.6
Marten	1	1	2	17	29	40	18	8	61	15	192	19.2
Mink	38	53	26	4	11	10	16	11	5	3	177	17.7
Muskrat	56	74	13	20	43	185	15	15	65	57	543	54.3
Otter	14	6	1	1	1	6	5	1	2	1	38	3.8
Weasel	34	39	15	2	3	11	24	4	7		139	13.9
TRAPLINE PE 190												
Beaver	14	3	3	V	44	19	V	15	8	14	120	12.0
Fisher				A			A				---	----
Fox-Arctic				C			C				---	----
Fox-Coloured				A			A				---	----
Lynx	1			N			N				1	.1
Marten			11	T	28	9	T	7	13	5	73	7.3
Mink	5	1	11		7	1		1	2	2	30	3.0
Muskrat			5		21			23		26	75	7.5
Otter					4	2		6	1	2	15	1.5
Weasel		2	14		1	2		2		3	24	2.4

Continued.....

	1958-1959	1959-1960	1960-1961	1961-1962	1962-1963	1963-1964	1964-1965	1965-1966	1966-1967	1967-1968	Ten Year Total	Average
TRAPLINE PE 200												
Beaver	169	177	83	150	150	107	109	75	63	145	1228	122.8
Fisher	4	2	2			3	2				13	1.3
Fox-Arctic											---	----
Fox-Coloured					1			1			2	.2
Lynx											---	----
Marten	9	18	48	65	25	86	47	87	6	13	404	40.4
Mink	41	49	10	15		9	6	4		6	140	14.0
Muskrat	15	43	1	22	31	33	41	14	10	36	246	24.6
Otter	5	3	2	2	5	6	4	1	3	2	33	3.3
Weasel	14	18	9	10	5	4	12	22	3	2	99	9.9
TRAPLINE PE 202												
Beaver	40	23	59	58	76	87	10	86	27	41	507	50.7
Fisher	1			1	2	1					5	.5
Fox-Arctic											---	----
Fox-Coloured	1							1			2	.2
Lynx		1									1	.1
Marten	1		6	9	25	28	3	30	77	8	187	18.7
Mink	25	13	19	11	14	17	3	5	4	8	119	11.9
Muskrat	55	76	18	15	33	59	6	16	20	15	313	31.3
Otter	5		7	2	3	11	1	1		4	34	3.4
Weasel	31	8	7	6	4	4	2	30	3		95	9.5

Continued.....

	1958-1959	1959-1960	1960-1961	1961-1962	1962-1963	1963-1964	1964-1965	1965-1966	1966-1967	1967-1968	Ten Year Total	Average
TRAPLINE PE 228												
Beaver		4				3		9	N	D	16	1.6
Fisher		2	1						O	I	3	.3
Fox-Arctic				1						D	1	.1
Fox-Coloured									R		---	----
Lynx		3				1			E	N	4	.4
Marten		3	5	15		61	39	18	T	O	141	14.1
Mink	8	22	44	2		20	4	2	U	T	102	10.2
Muskrat					8	184	8	44	R	T	244	24.4
Otter								1	N	R	1	.1
Weasel	2	37	13	3		6	7	6		A P	74	7.4
TRAPLINE PE 237												
Beaver	14	N	8	7	36	30	19	17	2	V	133	13.3
Fisher	1	O								A	1	.1
Fox-Arctic										C	---	----
Fox-Coloured		R								A	---	----
Lynx		E					1			N	1	.1
Marten	8	T	3	2	7	23	28	8	26	T	105	10.5
Mink	17	U	11	12	3	8	2	9	1		63	6.3
Muskrat	13	R			36	58	2	2	12		123	12.3
Otter	3	N	1	5	10	5	1	4			29	2.9
Weasel	22					1	2				25	2.5

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